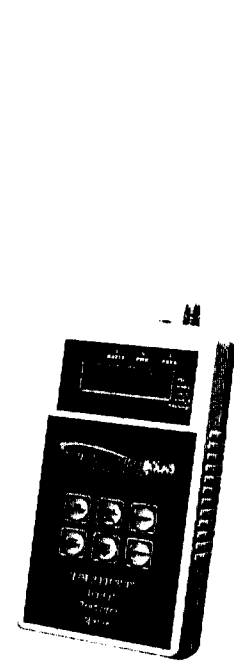
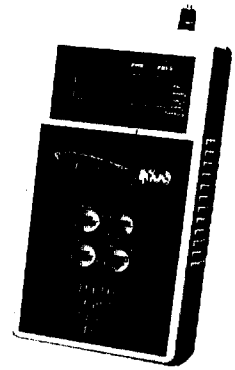




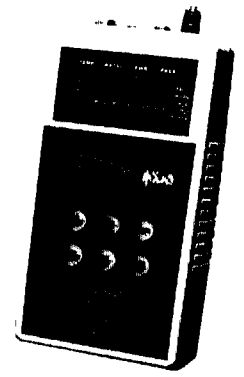
# DIGITAL PRESSURE METERS



DPM-2001PLUS



DPM-2001



DPM-2100

USER MANUAL

**BC BIOMEDICAL  
DPM-2001/2001 PLUS/2100  
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## BC GROUP DPM-2001/2001 PLUS/2100 DIGITAL PRESSURE METERS

The Model DPM-2001 Series is a Microprocessor based Digital Pressure Meter family. They measure both gas and liquid pressures and provide multiple engineering unit displays for the results. The DPM-2100 Series adds temperature measurement. The following are highlights of some of the main features.

### DPM-2001:

- -13.50 TO 100.00 PSI RANGE
- 0.1% FS ACCURACY (Pressure)
- PRESSURE SCALES INCLUDE PSI, inH<sub>2</sub>O, cmH<sub>2</sub>O, AND mmHg
- DIGITAL CALIBRATION – NO POTS TO TURN
- 5 DIGIT LCD PLUS SCALE INDICATION
- BATTERY LIFE DISPLAY (0 to 100%)
- PROGRAMMABLE DIGITAL FILTER
- LCD CONTRAST IS SOFTWARE ADJUSTABLE
- 16 BIT PRESSURE MEASUREMENT
- DIGITAL ZERO ADJUST

### DPM-2001 PLUS:

Includes all the features of the DPM-2001 and:

- MAX and MIN PRESSURE VALUE STORAGE
- RS232 SERIAL COMMUNICATIONS

### DPM-2100:

Includes all the features of the DPM-2001 and:

- MAX and MIN PRESSURE VALUE STORAGE
- RS232 SERIAL COMMUNICATIONS
- YSI 700 TEMPERATURE PROBE INTERFACE
- 0.0-100.0 C / 32.0-212.0 F TEMPERATURE RANGE
- 0.5% FS ACCURACY (Temperature)
- MAX and MIN TEMPERATURE VALUE STORAGE






**OPTIONAL ACCESSORIES:**



- BE2000PU 120 VAC BATTERY ELIMINATOR, U.S.
- BE2000PE 220 VAC BATTERY ELIMINATOR, EUROPE
- DPM2000C RS-232 CABLE
- BC20-01004 HARD CARRYING CASE
- BC20-01005 UNIVERSAL PRESSURE ADAPTER KIT

**SYSTEM INDICATORS**

Four indicators are provided to identify the Current Operating Mode.

**PRESSURE SCALE** – The pressure scale is indicated by an identifier bar. The RANGE key will toggle the pressure units among PSI, mmHG, inH<sub>2</sub>O and cmH<sub>2</sub>O. The following is a breakdown of the available pressure scales and the measurement range for each scale:

<u>Identifier Bar</u>	<u>Pressure Units</u>	<u>Pressure Range</u>
	PSIG	-13.50 to 100.00
	mmHg	-701 to 5190
	inH <sub>2</sub> O	-374 to 2773
	cmH <sub>2</sub> O	-951 to 7043
 (flashing)		

 bar  
 no bar

**NOTE:** If the measured pressure is outside of the range of the instrument, the display will display -HI- or -Lo-.

**NOTE:** InH<sub>2</sub>O, cmH<sub>2</sub>O and mmHg ranges are calibrated for 20 degrees Celsius.

**TEMPERATURE SCALE (MODEL DPM-2100 ONLY)** – The temperature can be displayed in either degrees Celsius or Fahrenheit. When temperature is displayed, the RANGE key will toggle the temperature units between Fahrenheit and Celsius.

<u>Temperature Units</u>	<u>Temperature Range</u>
Degrees C	0.0 to 100.0
Degrees F	32.0 to 212.0

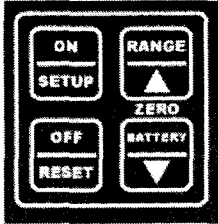
**NOTE:** If the measured temperature is outside of the range of the instrument, the display will display -HI- or -Lo-. If a probe is not connected, the display will show "no probe".

**LOW BATTERY** – When the battery life reaches 10 percent, the display will show the message "lo bat" once every minute.

**LINE POWER** – When meter is running from the optional Battery Eliminator (BE2000PU, BE2000PE), the display will show "Line" instead of the battery life remaining.

## KEYS – DPM-2001

Four tactile-touch keys are provided for system operation.



**ON/SETUP** – The function of this key is dependant on the Current Operating Mode as follows:

**POWER OFF** – If this key is pressed while the power is turned OFF, the power will be turned ON

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure is being displayed, the Setup Mode will be entered.

**SETUP MODE** – Pressing this key while in the Setup Mode will sequence the display through the available parameters.

**OFF/RESET** – The function of this key is dependant on the Current Operating Mode as follows:

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure is being displayed, the power will be turned OFF

**SETUP MODE** – Pressing this key while in the Setup Mode will exit the Setup Mode and automatically save all settings.

**RANGE/UP** – The function of this key is dependant on the Current Operating Mode as follows:

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure is being displayed, the unit will step through the available pressure ranges (PSI, inH<sub>2</sub>O, cmH<sub>2</sub>O and mmHg).

**SETUP MODE** – If this key is pressed in the Setup Mode, the value of the displayed setting will increment. Pressing and holding this key will cause the rapid automatic incrementing of the displayed setting.

**BATTERY/DOWN** – The function of this key is dependant on the Current Operating Mode as follows:

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure is being displayed, the unit will display the percent (0 to 100) of battery life remaining.

**NOTE:** If the optional wall mount power supply is used, the unit will display "Line".

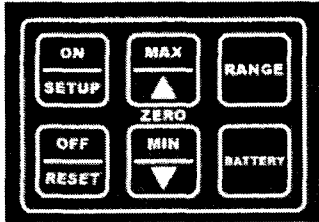
**SETUP MODE** – If this key is pressed in the Setup Mode, the value of the displayed setting will decrement. Pressing and holding this key will cause the rapid automatic decrementing of the displayed setting.

**ZERO** – This function is a combination of two keys (RANGE/UP and BATTERY/DOWN). If both keys are depressed and held for 5 seconds, the pressure display will be zeroed.

**NOTE:** If the BATTERY/DOWN key is depressed first, it will prevent the range from being changed in the process.

## KEYS – DPM-2001 PLUS

Six tactile-touch keys are provided for system operation.



**ON/SETUP** – The function of this key is dependant on the Current Operating Mode as follows:

**POWER OFF** – If this key is pressed while the power is turned OFF, the power will be turned ON

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure is being displayed, the Setup Mode will be entered.

**SETUP MODE** – Pressing this key while in the Setup Mode will sequence the display through the available parameters.

**OFF/RESET** – The function of this key is dependant on the Current Operating Mode as follows:

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure is being displayed, the power will be turned OFF

**SETUP MODE** – Pressing this key while in the Setup Mode will exit the Setup Mode and automatically save all settings.

**MIN/MAX MODE** – Pressing this key when a Min or Max Value is being displayed (MIN or MAX key is held down) will cause that value in that capture register to be reset to the current reading.

**MAX/UP** – The function of this key is dependant on the Current Operating Mode as follows:

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure is being displayed, the unit will display the maximum pressure detected since the capture register was last reset.

**SETUP MODE** – If this key is pressed in the Setup Mode, the value of the displayed setting will increment. Pressing and holding this key will cause the rapid automatic incrementing of the displayed setting.

**MIN/DOWN** – The function of this key is dependant on the Current Operating Mode as follows:

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure is being displayed, the unit will display the minimum pressure detected since the capture register was last reset.

**SETUP MODE** – If this key is pressed in the Setup Mode, the value of the displayed setting will decrement. Pressing and holding this key will cause the rapid automatic decrementing of the displayed setting.

**ZERO** – This function is a combination of two keys (MAX/UP and MIN/DOWN). If both keys are depressed and held for 5 seconds, the pressure display will be zeroed.

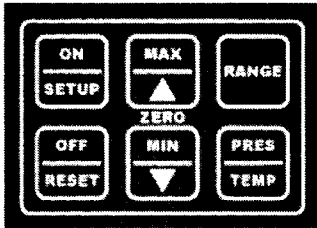
**RANGE** – The function of this key is to select the desired display engineering units. When viewing pressure it will sequence through the four ranges (PSI, inH<sub>2</sub>O, cmH<sub>2</sub>O and mmHg).

**BATTERY** - If this key is pressed while the pressure is being displayed, the unit will display the percent (0 to 100) of battery life remaining.

NOTE: If the optional Battery Eliminator is used, the unit will display "Line".

## KEYS – DPM-2100

Six tactile-touch keys are provided for system operation.



**ON/SETUP** – The function of this key is dependant on the Current Operating Mode as follows:

**POWER OFF** – If this key is pressed while the power is turned OFF, the power will be turned ON

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure is being displayed, the Setup Mode will be entered.

**SETUP MODE** – Pressing this key while in the Setup Mode will sequence the display through the available parameters.

**OFF/RESET** – The function of this key is dependant on the Current Operating Mode as follows:

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure or temperature is being displayed, the power will be turned OFF

**SETUP MODE** – Pressing this key while in the Setup Mode will exit the Setup Mode and automatically save all settings.

**MIN/MAX MODE** – Pressing this key when a Min or Max Value is being displayed (MIN or MAX key is held down) will cause that value in that capture register to be reset to the current reading.

**MAX/UP** – The function of this key is dependant on the Current Operating Mode as follows:

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure is being displayed, the unit will display the maximum pressure detected since the capture register was last reset.

**TEMPERATURE MEASUREMENT** – If this key is pressed while the temperature is being displayed, the unit will display the maximum temperature detected since the capture register was last reset.

**SETUP MODE** – If this key is pressed in the Setup Mode, the value of the displayed setting will increment. Pressing and holding this key will cause the rapid automatic incrementing of the displayed setting.

**MIN/DOWN** – The function of this key is dependant on the Current Operating Mode as follows:

**PRESSURE MEASUREMENT** – If this key is pressed while the pressure is being displayed, the unit will display the minimum pressure detected since the capture register was last reset.

**TEMPERATURE MEASUREMENT** – If this key is pressed while the temperature is being displayed, the unit will display the minimum temperature detected since the capture register was last reset.

**SETUP MODE** – If this key is pressed in the Setup Mode, the value of the displayed setting will decrement. Pressing and holding this key will cause the rapid automatic decrementing of the displayed setting.

**ZERO** – This function is a combination of two keys (MAX/UP and MIN/DOWN). If both keys are depressed and held for 5 seconds, the pressure display will be zeroed.

**RANGE** – The function of this key is to select the desired display engineering units. When viewing pressure it will sequence through the four ranges (PSI, inH<sub>2</sub>O, cmH<sub>2</sub>O and mmHg). When viewing temperature, it will toggle between Centigrade and Fahrenheit.

**PRES/TEMP** – The function of this key is to toggle between pressure and temperature displays.

## SETUP MODE

The Setup Mode allows the user to adjust the configuration of the meter. The Setup Mode is entered by pressing The ON/SETUP key when the unit is on. The parameter and the current value will alternately flash in the display. The following table indicates the Parameters that are available, their meaning and available setting range:

<u>PARAMETER</u>	<u>DESCRIPTION</u>	<u>RANGE</u>
BAT	REMAINING BATTERY LIFE	0 - 100 %
CONT	CONTRAST	0 - 15
AOFF	AUTO OFF TIMER	0 - 30 MINUTES
BEEP	KEY BEEP LENGTH	0 - 15
FCON	DIGITAL FILTER CONSTANT	1 - 255

**BAT – (MODEL 2100 ONLY)** This parameter gives an indication of the remaining battery power. The battery life is displayed as percent of life.

**CONT** – This parameter controls the contrast of the LCD display. A Higher setting will cause the display to darken. A lower setting will cause the display to lighten.

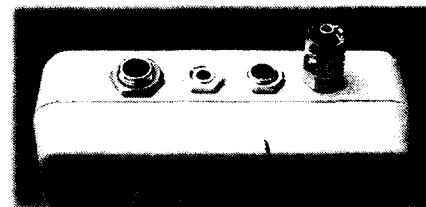
**AOFF** – This parameter determines the period of inactivity before the meter is turned OFF. A timer is started when the meter is turned ON and is reset each time a key is pressed. When the timer reaches the value set in this parameter, the power is automatically turned OFF.

**NOTE:** Setting this parameter to 0 disables the Auto Off timer. When running from line power, the meter will not automatically shut off.

**BEEP** – This parameter controls the length of the audio feedback beep (click) that occurs when a key is depressed. A Higher setting will cause a longer (louder) beep. If the value is set to 0, the beep is eliminated.

**FCON** – This parameter controls the Filter Constant. The software has a Digital Filter that averages the pressure readings to produce a stable display. This setting determines the number of samples that are averaged in the digital filter. Increasing this setting will cause a more stable display. However, it will also cause a slower response to small changes in pressure. The best setting is the smallest number that provides a stable display.

## INPUTS



**PRESSURE INPUT** – Male luer lock connector is used for the pressure input.

**POWER INPUT** – A 2.1 mm jack is provided for the optional 9 VDC Battery Eliminator power supply that may be used for continuous run applications. It bypasses the internal battery when plugged in.

**RS232** – This is the serial interface connector. **(MODELS 2001 PLUS AND 2100 ONLY)**

**TEMPERATURE INPUT** – A 1/4" phono jack is provided to accept any standard YSI Series 700 Temperature Probe. **(MODEL 2100 ONLY)**



## STATUS DISPLAYS

**LOW BAT** – This status screen displays when the battery reaches a critical low level. LOW BAT is displayed for two seconds once a minute until the battery is replaced.

**DEF CAL** – This status screen displays on Power Up if the unit is out of Calibration. The unit will load default values. The unit should be returned to the Factory for Calibration.

## COMMUNICATIONS

Since the meter does not handle a great deal of data, the link has been optimized to allow the user, through very simple instructions, to control and interrogate the meter. NOTE: RS232 is only available on DPM-2001 Plus and DPM-2100 models.

Use RS232 Cable P/N DPM2000C to connect from the RS232 connector on the top of the DPM to a DB9 Com Port connector on a PC. The DPM is configured as Data Communications Equipment (DCE) and is intended to connect directly to Data Terminal Equipment (DTE). This is the standard direct connection to a PC.

The Link communicates at a fixed 115,200 baud with 8 bit data, 1 stop bit, 1 start bit, no parity and no handshaking.

The following section describes the JPC Protocol used by the meter.

The JPC Protocol consists of 6 basic commands:

- R - READ
- W - WRITE
- U - UPLOAD
- Q - QUICKSEND
- V - VERSION
- X - CANCEL

The data format is standard ASCII and all data are BCD values.

The following is a breakdown of each of the commands and the way they are accessed. The meter will echo all characters that are typed to it. When used with a terminal, this will provide the appropriate display. When used with a computer system, this will provide direct feedback of the fact that unit has accepted the data.

All commands are completed with a carriage return from the computer. All commands will be acknowledged by a carriage return, line feed (\$0D,\$0A). If a command is not valid, the meter will respond with "??". All commands are not case sensitive.

## READ/WRITE COMMANDS

The READ command is utilized to read from the meter any of the gathered data. The command is entered as a letter followed by 2 numbers, followed by a carriage return:

R(Location)(Return)

The 'R' indicates to the meter that the command is to be a READ command.

The Location contains two digits that indicate the data location that is to be read.

The carriage return indicates that the command is to be activated.

The WRITE command allows the user to update the system settings. The write command is entered as a letter followed by 7 numbers, followed by a carriage return.

W(Location)(Data) (Return)

The 'W' indicates to the meter that the command is to be a WRITE command.

The Location contains two digits that indicate the data location that is to be read.

The Data contains five digits that indicate the data that is to be written at the desired location.

The carriage return indicates that the command is to be activated.

LOCATION	ACCESS	DESCRIPTION	RANGE
01	R	% BATTERY LIFE REMAINING	0-100
02	R/W	CONTRAST	0-15
03	R/W	AUTO POWER OFF	0-30
04	R	RESERVED	0-65535
05	R	RESERVED	0-65535
06	R	RESERVED	0-65535
07	R	RESERVED	0-65535
08	R/W	FILTER CONSTANT	0-255
09	R	RESERVED	0-65535
10	R	MODEL	0 = DPM-2001 1 = DPM-2001+ 2 = DPM-2100
11	R	PRESSURE	See Note 1
12	R	MAX PRESSURE	See Note 1
13	R	MIN PRESSURE	See Note 1
14	R	TEMPERATURE	See Note 1
15	R	MAX TEMPERATURE	See Note 2
16	R	MIN TEMPERATURE	See Note 2
17	R/W	PRESSURE UNITS	0=PSI 1=mmHg 2=inH2O 3=cmH2O
18	R/W	TEMPERATURE UNITS	0=Celsius 1=Fahrenheit

Note 1 – The units for the pressure data is determined by the setting in Location 17. This may be set via the Write command or manually using the Range Key. See Specifications Page for Ranges.

Note 2 – The units for the temperature data is determined by the setting in Location 18. This may be set via the Write command or manually using the Range Key. See Specifications Page for Ranges.

The following is an example of how the Read/Write commands are used. For display purposes, the symbol <cr> will be used to identify a carriage return (\$0D), and the symbol <lf> will be used to identify a line feed (\$0A).

<u>Data Sent</u>	<u>Data Returned</u>	<u>Meaning</u>
R03<cr>	R03<cr><lf> 00010<cr><lf>	Echo of Command Sent Auto Off is set to 10 minutes
W0300000<cr>	W0300000<cr><lf>	Echo of Command Sent Change Auto off to disabled

### UPLOAD COMMAND

The Upload command allows the user to read all of the selected device data from locations through 18 with a single command. The data will be transmitted as a single block with each location separated by a carriage return, linefeed (\$0D,\$0A).

The following is the format for this command:

U (Return)

See the table in the Read Command section for details on the data structure.

### QUICKSEND COMMAND

Quicksend is a feature that allows the user to receive an automatic update of all of the meter data without any user interaction. When the Quicksend feature is turned ON, the meter will automatically send all of the device data every half second. The Quicksend feature is toggled ON and OFF with the Quicksend command.

The following is the format for the 'Q' command:

Q (RETURN)

See the table in the Read Command section for details on the data structure.

### VERSION COMMAND

The Version command allows the user to read the Software Version that the unit is running.

To read the Version, the following syntax is used:

V (RETURN)

### CANCEL COMMAND

The CANCEL command is simply a way to re-establish proper control, should an error occur or an incorrect command be transmitted. For the most part, an incorrect command will simply be ignored and the meter will prepare for an additional command. However, a command may be cancelled midstream by transmitting an 'X' (ASCII). This command does not require a carriage return, nor will it acknowledge with a carriage return. However, it will echo an 'X' to indicate that the CANCEL command has been received.

The command may also be utilized as a clear and/or acknowledgement of the meter being on line.

## MANUAL REVISIONS

Revision #	Program #	Revisions Made
ev 01	DT7325CA	Preliminary Manual
ev 02	DT7325CA	Editing/Drawing Updates
ev 03	DT7325CA	Battery Eliminator
ev 04	DT7325CB	Status Displays
ev 05	DT7325CD	Accuracy Upgrades
ev 06	DT7325CG	Program Upgrades, Color Overlays
ev 07	DT7325CG	Dimensional Drawings Removed

## LIMITED WARRANTY

**WARRANTY:** BC GROUP INTERNATIONAL, INC. WARRANTS ITS NEW PRODUCTS TO BE FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP UNDER THE SERVICE FOR WHICH THEY ARE INTENDED. THIS WARRANTY IS EFFECTIVE FOR TWELVE MONTHS FROM THE DATE OF SHIPMENT.

**EXCLUSIONS:** THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTY EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

BC GROUP INTERNATIONAL, INC. IS NOT LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.


NO PERSON OTHER THAN AN OFFICER IS AUTHORIZED TO GIVE ANY OTHER WARRANTY OR ASSUME ANY LIABILITY.

**REMEDIES:** THE PURCHASER'S SOLE AND EXCLUSIVE REMEDY SHALL BE: (1) THE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS OR PRODUCTS, WITHOUT CHARGE. (2) AT THE OPTION OF BC GROUP INTERNATIONAL, INC., THE REFUND OF THE PURCHASE PRICE.

## SPECIFICATIONS

### DPM-2001/DPM-2001 PLUS/DPM-2100 DIGITAL PRESSURE METERS

PRESSURE RANGE	-13.50 to 100.00 PSI -701 to 5190 mmHg @ 20C -374 to 2773 inH <sub>2</sub> O @ 20C -951 to 7043 cmH <sub>2</sub> O @ 20C
PRESSURE RESOLUTION	0.01 PSI 1 inH <sub>2</sub> O 1 cmH <sub>2</sub> O 1 mmHg
PRESSURE ACCURACY	+/- 0.1% FS
TEMPERATURE RANGE (DPM-2100 MODELS ONLY)	0.0 to 100.0 °C 32.0 to 212.0 °F
TEMPERATURE RESOLUTION	0.1 °C 0.1 °F
TEMPERATURE ACCURACY	+/- 0.5% FS
DISPLAY	Six, 0.35 Inch High, Seven Segment, LCD Uniplanar digits.
SETUP MEMORY	EEPROM, All Parameters
MEMORY RETENTION	10 Years w/o Power
OPERATING RANGE	0 to 50 Degrees C
STORAGE RANGE	-40 to 60 Degrees C
CONSTRUCTION	Enclosure – ABS Plastic. Face – Lexan, Back Printed

SIZE	7.09 x 3.94 x 1.56 inches 180 x 100 x 40 mm (HxWxD)
WEIGHT	≤ 1 lbs. (0.45 kg)
CONNECTIONS	Power – 2.1mm Center Negative RS-232 – 1/8 inch phono Pressure – Male Luer Temperature – 1/4 inch phono
TEMPERATURE SENSOR	Directly compatible with all YSI Series 700 Temperature Probes or equivalent
PRESSURE MEDIA	Any pure fluid or gas that is compatible with Pyrex, Glass, Silicon, Alumina Ceramic, Epoxy, RTV, gold, aluminum, and nickel.
POWER	LINE: 9VDC, Center Negative BATTERY: 9V Alkaline
POWER CONSUMPTION	ON: less than 6mA OFF: less than 20μA
BATTERY LIFE	CONTINUOUS: 80 hrs. OFF: 12 months
BATTERY ELIMINATOR (Optional)	BE2000PU (120 VAC) - US BE2000PE (220 VAC) – Euro 9V, 50 mA DC 

**NOTES**